ISOPLERE EQUATIONS OF A BINARY MIXTURE IN THE VICINITY OF VAPOR-LIQUID CRITICAL POINT IN THE FRAMEWORK OF SCALING THEORY

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An analytical expression of liquid phase (or gas phase) volume of a binary mixture in the vicinity of liquid-vapor critical point have been obtained in the framework of scaling theory and isomorphism concept of critical phenomena in mixtures [1,2]. The behavior of liquid phase volume was studied along the lines of fixed average densities ρ (isochores), lines of constant temperatures T or pressures P. It has been shown that the liquid phase volume reveals nonmonotonic behavior resulting in the appearance of specific maximums. The equations which determine the locations of such maximums have been derived. In particular, it was demonstrated that the maximum of liquid phase v_L arising at variation of the temperature T on the isochore exists only for densities less than critical density ρ_c whereas the value of this maximum does not exceed the half of system volume. The analytical equations of isopleres in the vicinity of liquid-vapor critical point for pressure-temperature and temperature-density variables have been obtained. The expressions for the temperature derivatives of pressure and mixture density along the isopleres were also derived. It was shown that the equations which determine the positions of the so-called special points of dew-bubble curves, namely, the points of maximal pressure and temperature (cricondenbar and cricondentherm) result directly from these derivative expressions.

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1. Belyakov M.Yu., Gorodetskii E.E., Voronov V.P., Kulikov V.D. // Chem. Phys. 2014. V. 445. P. 53.
2. Belyakov M.Yu., Voronov V.P., Gorodetskii E.E., Kulikov V.D. // JETP Lett. 2008. V. 88. P. 302.